RAND

Executive Summary of Analyses for the Initial Implementation of the Inpatient Rehabilitation Facility Prospective Payment System

Grace M. Carter, Joan L. Buchanan, Melinda Beeuwkes Buntin, Orla Hayden, Susan M. Paddock, Jennifer Kawata, Daniel A. Relles, Gregory K. Ridgeway, Mark E. Totten, Barbara O. Wynn

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PREFACE

This report describes the research that RAND performed to support the efforts of the Health Care Financing Administration (HCFA) to design, develop, and implement a Prospective Payment System (PPS) for inpatient rehabilitation. It presents recommendations concerning the payment system and also discusses our plans for further research on the monitoring and refinement of the PPS.

In the Balanced Budget Act of 1997, Congress mandated that HCFA implement a PPS for inpatient rehabilitation. The Centers for Medicare and Medicaid Services (CMS, the successor agency to HCFA) issued the final rule governing such a PPS on August 7, 2001. The PPS will start on January 1, 2002. This rule reflects policy analyses and decisions that took into account other contextual analyses and the experience of other PPSs as well as the research presented here. This report is a research document, not a policy document, and should be viewed as a contribution to understanding inpatient rehabilitation.

This is an executive summary of research reported more fully in four other volumes. They are:

Carter, G. M., M. Beeuwkes Buntin, O. Hayden, J. Kawata, S. M. Paddock, D. A. Relles, G. K. Ridgeway, M. E. Totten, and B. O. Wynn (2002). *Analyses for the Initial Implementation of the Inpatient Rehabilitation Facility Prospective Payment System*. Santa Monica, CA: RAND, MR-1500-CMS.

Buchanan, J. L., P. Andres, S. Haley, S. M. Paddock, D. C. Young, and A. Zaslavsky (2002). *Final Report on Assessment Instruments for PPS*. Santa Monica, CA: RAND, MR-1501-CMS.

Relles, D. A., and G. M. Carter (2002). *Linking Medicare and Rehabilitation Hospital Records to Support Development of a Rehabilitation Hospital Prospective Payment System*. Santa Monica, CA: RAND, MR-1502-CMS.

Carter, G. M., D. A. Relles, B. O. Wynn, J. Kawata, S. M. Paddock, N. Sood, and M. E. Totten (2002). *Interim Report on an Inpatient Rehabilitation Facility Prospective Payment System*. Santa Monica, CA: RAND, MR-1503-CMS.

The second volume listed above evaluates two alternative data instruments that had been proposed as a means of gathering case mix data from hospitals. The first volume provides analyses related to all other aspects of the new payment system. The Relles et al. report provides additional information on our database, especially about the methodology used to link multiple sources of data describing the same discharge. The last volume is a preliminary report that HCFA used to help prepare the Notice of Proposed Rule Making during the summer and fall of 2000.

Together, these documents constitute the final report for phase I of our study of the design, development, monitoring, and refinement of an Inpatient Rehabilitation Facility Prospective Payment System.

This research has been supported by HCFA through contract 500-95-0056. The Buchanan et al. study was performed largely at Harvard, through a subcontract, with funding coming through the same HCFA-RAND contract.

CONTENTS

FIGURE

TABLES

ACKNOWLEDGMENTS

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We thank Dr. Margaret Stineman of the University of Pennsylvania and Dr. Laurie Feinberg of CMS for helpful discussions concerning impairment groups and comorbidities.

We thank Carl Granger and Dick Linn of UDSmr (Uniform Data System for medical rehabilitation), Jill Engholm of Caredata.com, and Jean Davis of HealthSouth for the use of their data and for their help in data interpretation.

We are grateful to Jose Escarce of RAND Health for many suggestions for improvements to an earlier draft of this report.

The members of our Technical Expert Panel (TEP) reviewed our interim report and this final report. During these reviews and in subsequent discussions and correspondence they made many suggestions that have been incorporated into the analyses that are presented here. We thank each of the TEP members, whose names are listed on the next page, for their time and effort.

We thank Donna White for her assistance throughout this project, including her careful preparation of multiple versions of this manuscript.

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ACRONYMS

CART	Classification and Regression Trees
CMG	Case Mix Group
CMI	Case Mix Index
CMS	Centers for Medicare and Medicaid Services (successor agency to HCFA)
COS	Clinical Outcomes Systems
CY	Calendar year
FIM	Functional Independence Measure
FRG	Function Related Group
FRGC	Function Related Group with comorbidities
FY	Fiscal year
GAM	Generalized Additive Models
HCFA	Health Care Financing Administration
HSRV	Hospital Specific Relative Value
IRF	Inpatient Rehabilitation Facility
LE	Lower extremity
LOS	Length of stay
MART	Multiple Adaptive Regression Trees
MDS-PAC	Minimum Data Set–Post Acute Care
MEDPAR	Medicare Provider Analysis and Review
MMT	Major multiple trauma
NPRM	Notice of Proposed Rule Making
PAC	Post-acute care
PAI	Patient assessment instrument
PPS	Prospective Payment System
RIC	Rehabilitation Impairment Category
SSI	Supplemental Security Income
TEFRA	Tax Equity and Fiscal Responsibility Act
TEP	Technical Expert Panel

INTRODUCTION

In the Balanced Budget Act of 1997, Congress mandated that the Health Care Financing Administration (HCFA) implement a Prospective Payment System (PPS) for inpatient rehabilitation under Medicare. This new PPS will be implemented beginning January 1, 2002. This report describes the research that RAND performed to support HCFA's efforts to design, develop, and implement this Inpatient Rehabilitation Facility PPS, or IRF PPS. It presents recommendations concerning the payment system and also discusses our plans for further research on the monitoring and refinement of the PPS.

The new PPS will apply to rehabilitation hospitals and to distinct rehabilitation units of acute care hospitals that were excluded from the acute care PPS. Medicare patients in such facilities must receive intensive therapy (generally at least three hours per day). In addition, 75 percent of each facility's patients must have one of ten specified problems related to neurological or musculoskeletal disorders or burns.

Since 1982, Medicare payment for these rehabilitation facilities has been made under the Tax Equity and Fiscal Responsibility Act (TEFRA). The payment amount depends on a per-case target amount that is calculated from historical costs at the facility trended forward and on the hospital's actual cost per case. Under TEFRA, there is no adjustment for changes in a hospital's case mix or for outlier cases. This lack of adjustment creates incentives for providers to specialize in relatively less-expensive cases and, as a result, might limit beneficiary access. TEFRA pays for discharges that do not include a full course of rehabilitation (e.g., short stays for evaluation, transfer cases) as full cases. These payments in excess of costs may have both quality and cost-control implications.

TEFRA was widely perceived to be unfair to older hospitals. Until the Balanced Budget Act of 1997, newer hospitals were not subject to the same incentives for efficiency and indeed were rewarded for incurring higher costs in their base year(s).

The initial design of the IRF PPS was first presented in a Notice of Proposed Rule Making (NPRM) (HCFA, 2000). Our interim report, Carter et al. (2002), presented analyses that HCFA used to help make its decisions in the NPRM. In this report, we update these analyses using more-recent data. We also improve the analysis and our recommendations to the Centers for Medicare and Medicaid Services (CMS, the successor agency to HCFA) by taking into account comments made by our Technical Expert Panel (TEP) in its review of our interim report, as well as suggestions made by HCFA staff in response to public comments on the NPRM. This is a report of research. The final decisions made by CMS and the rationale for those decisions may be found in the rule governing the IRF PPS (CMS, 2001).

Payment Under the IRF PPS

The unit of payment in the IRF PPS will be a Medicare-covered hospital stay, beginning with an admission to the rehabilitation hospital or unit and ending with discharge from that facility. Each case will be classified into a Case Mix Group, or CMG. The CMGs are based on impairment, functional status as

measured by items from the Functional Independence Measure (FIM), age, and comorbidities. The CMGs will be assigned based on information in a new patient assessment instrument (the IRF PAI). Additional groups for deaths and atypically short stay cases will be assigned based on claims data.

The IRF PPS payment for a discharge in hospital i in CMG k is given by

$$F = R * A_i * W_k ,$$

where R is the national conversion factor, A_i is the facility payment adjustment, and W_k is the CMG relative weight. This payment will be increased for outlier cases. Also, short-stay transfer cases will receive a payment for each day in the hospital plus a case-level payment equal to one-half of one day's payment.

Two-thirds of the IRF PPS payment amount plus one-third of the amount that would be paid under TEFRA will be paid in fiscal year (FY) 2002. Facilities may choose to be paid entirely under the IRF PPS in FY 2002. In the following years, all payments to all IRFs will be made under the IRF PPS. The initial value of R was chosen to meet the statutory budget neutrality constraint that payment under the new PPS should equal what payment would have been under TEFRA, as estimated by the CMS's Office of the Actuary.

Approach

To ensure access to quality care for all Medicare patients, the PPS must identify patient groups that need different levels of resources and then pay for each group in proportion to cost. The system should be fair to hospitals by paying for costs that are outside the control of hospital administrators, such as area wage levels or a population that is disproportionately poor. The payment system must allow CMS to control its budget for post-acute care. It must provide incentives for hospitals to provide quality care and limit incentives for "gaming the system."

In order to meet these criteria, all major system parameters are calculated from data describing rehabilitation facilities' case mix and cost. We began our work using only 1996 and 1997 data and made recommendations for HCFA's use in developing the NPRM. In this final report, we have extended our analyses and updated them with 1998 and 1999 data.

Finally, we analyzed options for each of the elements of the PPS. This executive summary presents the major findings from these analyses and our recommendations to CMS.

DATA

Our primary data source is a file that provides case mix data on Medicare discharges from inpatient rehabilitation facilities. We also used annual Medicare cost reports and a file constructed by the CMS Office of the Actuary that projects the cost report data into FY 2002. We constructed a file of hospital characteristics, which we used to analyze hospital costs and the likely outcome of policy alternatives.

The information on our case mix file comes from two sources: (1) discharge abstracts collected on all Medicare patients by HCFA in the course of administering the Medicare program; and (2) additional patient information, including the FIM, recorded by a subset of rehabilitation hospitals.

HCFA sent us records of all calendar year (CY) 1996 through 1999 discharges from the Medicare Provider Analysis and Review (MEDPAR) file. The IRF records from the MEDPAR constitute the statistical universe for our analysis. We combined the MEDPAR information with cost-to-charge ratios and routine care costs from the Medicare cost report to estimate the accounting cost of each discharge in the rehabilitation universe.

Our FIM data come from the Uniform Data System for medical rehabilitation (UDSmr), from the Clinical Outcomes Systems (COS) data for medical rehabilitation, and from HealthSouth. COS provided us with their data for CYs 1996 and 1997 and ceased to operate in early 1998. HealthSouth was one of COS's major clients and provided us data for CYs 1998 and 1999 from the HealthSouth corporate database, thus giving us complete 1996–1999 coverage for many of its hospitals. The data found in all three FIM databases include descriptions of the patient and the hospitalization, including the condition requiring rehabilitation, ICD-9-CM diagnoses, and the FIM items at admission and discharge.

The MEDPAR and FIM records that described the same discharges were linked using a probability matching algorithm. We were able to match 90.1 percent of 1999 MEDPAR records for facilities that appeared in a FIM database throughout the year. We matched 95.9 percent of 1999 FIM records for which Medicare is listed as the primary payer. The numbers were approximately the same in each of the four sample years.

As shown in Table 1, our analysis file includes roughly half the cases and hospitals in the rehabilitation universe in each year. By 1999, our analysis file of over 240,000 cases contained 63.9 percent of all rehabilitation discharges and came from 59.6 of all rehabilitation facilities.

Table 1

Size of Universe and Percent in Analysis Sample, by Calendar Year

	Discharges		Facilities	
Year	Number in Universe	Percent in Analysis Sample	Number in Universe	Percent in Analysis Sample
1996	344,126	48.5	1,081	50.9
1997	359,032	56.0	1,123	54.6
1998	370,352	61.5	1,155	57.6
1999	390,048	63.9	1,165	59.6

NOTE: The annual rehabilitation facility universes were defined as those facilities with at least one MEDPAR IRF discharge in that year.

We analyzed how well our sample represents the universe. The discharges in the sample are very representative on all patient characteristics. The sample does, however, slightly underrepresent rural facilities, units (especially the smallest units), and small freestanding hospitals. For 1999 we have almost half of the universe in each of these underrepresented categories.

DEVELOPING NEW FUNCTION-RELATED GROUPS

The major subdivisions in the case classification system are based on primary reason for rehabilitation, functional status at admission, and age. We built on the Function Related Group (FRG) classification methodology developed in Stineman et al. (1994), which used CART (Classification and Regression Trees) to develop FRG definitions based on these same factors. These new FRGs formed the basis of our recommended CMGs.

We used the four years of data (1996 through 1999) to examine improvements in the way the FIM data are entered into the CART model and to examine the predictive power of the CART-based FRGs relative to that of "gold standard" models. The gold standard models were built using the most up-to-date statistical techniques available: Generalized Additive Models (GAM) and Multiple Adaptive Regression Trees (MART). These powerful predictive models produce complicated functions. Although very accurate, the functions are not amenable to creating a readily understood classification system for payment.

Rehabilitation Impairment Categories

The first step in the development of FRGs is to partition the data into clinically similar groups, called Rehabilitation Impairment Categories (RICs), based on the primary reason for the rehabilitation admission. In our interim report, we evaluated many alternative ways to group impairment codes to predict new RICs. We found only two improvements over the grouping that was used in version 2 of the FRGs (Stineman et al, 1997).

- We defined a new RIC for burns.
- We grouped "status post major multiple fractures" in the "major multiple trauma without brain or spinal cord injury" RIC.

In the NPRM, HCFA used our recommended definitions for 21 RICs. Throughout this report, we also use the same definitions.

Classifying by Function and Age

The second step in the creation of FRGs is to partition the cases within each RIC into groups that are relatively homogeneous with respect to cost. CART does so by repeated binary splits on the independent variables that enter the model. In the original FRGs developed by Stineman et al., the independent variables consisted of age and the FIM motor and cognitive scales. Each of the scales is the sum of responses to individual FIM items.

For each functional item, increasing functional independence should be correlated with decreasing cost. We found two items that did not meet this expectation. First, transfer to tub/shower was incorrectly (i.e., positively) correlated with cost (after controlling for other FIM items) within almost all RICs. A comparison of the regular motor score with one that drops this item shows that the modified scale was a better predictor of costs in gold standard models in all data years. Within CART, the modified motor score also produced slightly better predictions. Further, the response to this item depends on the situation being scored—either tub or shower and with or without assistive devices. Thus it is only a relative measure of independence rather than an absolute one. In addition, this item is not reliably coded in our database because it is frequently not assessed at admission. Consequently, we recommended defining FRGs using a modified motor scale that does not contain this item.

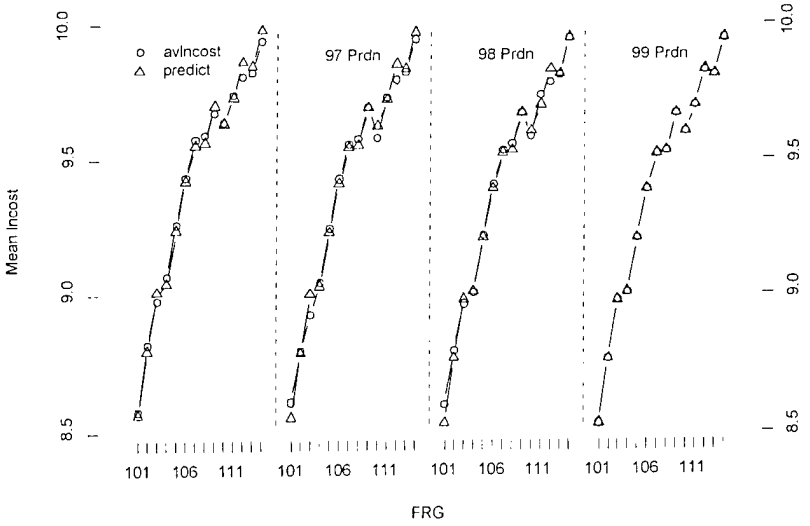
The second item that was not correlated with cost as expected is comprehension. Eliminating this item results in even smaller improvements in performance than dropping transfer to tub. The cognitive scale is used only occasionally in the definition of FRGs. When it is used, the other four items in the cognitive scale determine the direction of the cognitive effect, so that a higher cognitive score results in a lower payment. Thus, eliminating the comprehension item raises issues related to incentives and fairness. If we take the comprehension item out of the cognitive index, the system will provide no extra incentives to treat patients with lowered comprehension. If some hospitals do spend extra to treat such patients, they will not be compensated for the extra resources expended. Consequently, we recommended keeping this item.

We also examined various sub-scales of the motor and cognitive scales. Although these sub-scales improve the predictive ability of the gold standard models, CART was unable to produce trees with a manageable number of nodes from these indices.

Evaluating Groups

We found that FRGs built using CART on the FIM data can predict cost reasonably well. They offer a parsimonious payment formula while maintaining prediction accuracy. The CART model creates about 100 FRGs that explain roughly 81 to 85 percent of the variance explained by the gold standard models that use the most detailed scales, depending on year. If we compare the CART model with the gold standard models that use only the same indices as CART (instead of more information), we explain over 90 percent of the "explainable variance."

Our recommended FRGs contain 95 groups and are the basis of the Case Mix Groups used in CMS's final rule. These groups, although defined on the 1999 data, fit well in all years. We compared actual and predicted FRG means for non-fitting years in each RIC. Figure 1 shows the data for RIC 1 as an example. (Similar figures for all RICs are presented in the full report, [Carter et al., 2002].) The actual and predicted mean log costs are quite close. The actual means in adjacent FRGs seem to be well separated



NOTE: RIC=01, Fityear=99.

Figure 1—Actual and Predicted FRG Means

from one another in each year, indicating that the FRGs continue to discriminate between groups with differing levels of cost.

Last, we attempted to quantify the effect of the simple FRG payment formula on total hospital payments. We computed what each hospital would be paid (absent comorbidity adjustments) in each year using the recommended FRGs versus the gold standard payment formulas. We found that, for example, using MART and the gold standard models based on the chosen motor and cognitive sub-scales, about 94 percent of cases would go to hospitals having payment that would differ from the CART payment by 2 percent or less, and only about 0.3 percent of cases would go to hospitals having payment fractions outside the range from 0.94 to 1.04. That is, CART and MART would pay hospitals about the same. Results were similar for GAM. We think these results provide additional confirmation for using the proposed set of FRGs.

The recommended CMGs are shown in the first 95 rows of Table A.1 in the appendix. The first two digits of the CMG indicate the RIC (stroke, traumatic brain injury, etc.); the last two digits indicate the group within the RIC. The table gives the RIC and the values of the motor score (modified to eliminate transfer to tub), cognitive score, and age that define each group.

COMORBIDITIES

Our clinical consultants and TEP members suggested a variety of hypotheses about comorbidities and complications that affect cost. We tested each hypothesis to determine whether the nominated conditions were in fact associated with increased cost after controlling for FRG. These tests resulted in a list of conditions that are correlated with higher costs and that our clinical consultants believe actually cause an increase in costs.

We examined a series of alternative ways of incorporating extra payments for cases with relevant comorbidities into the payment system. We evaluated these alternatives with respect to the extent to which they match payments to cost, their stability over time, and the threat they pose to budget neutrality.

Based on this analysis, we recommended using three tiers to pay for relevant comorbidities in the initial year(s) of the IRF PPS. We found that some infrequent comorbidities cost substantially more than other comorbidities. We believe the difference is large enough that payment should be matched to cost in order to avoid problems with access and to provide adequate resources for these expensive patients. These expensive comorbidities, each of which increase cost by more than 15 percent on average, constitute tier 1. The remaining relevant comorbidities that affect cost were divided based on the size of their effect on cost. Comorbidities with a regression coefficient between 11 and 15 percent constitute tier 2, and comorbidities with a coefficient between 4 and 10 percent constitute tier 3 (see Table 2). The facility would receive a payment according to the most expensive tier for which the patient qualifies.

We also recommended that the amount of the additional payment for each tier be calculated based on RIC-specific data. The effects of the RIC are statistically important and have been consistent in every model we tried. Within each RIC, cost effects consistently vary with the tiers as we defined them based on their performance over all RICs.

There are reasons to be concerned about the quality of ICD-9-CM coding in our database. These fields have not been used routinely for analyses; the number of fields available on the FIM instrument to note comorbidities varied by source. Because comorbidities are probably undercoded in our data, we believe that paying a separate amount for each comorbidity might seriously threaten budget neutrality and could conceivably lead to upcoding. Further, paying a different amount for each comorbidity would cause payment amounts to vary from year to year and would add very little accuracy to the prediction of cost.

This comorbidity recommendation was used by CMS in its final rule. Although we are very confident that the rule will lead to reasonable payment amounts, there are several ways in which we would like to pursue refinement in the coming years, when we will have a more representative and better-coded database. First, we would like to systematically address all ICD-9-CM codes, rather than just the ones hypothesized by our clinical experts. Second, we would like to pursue the possibility of a complexity adjustment that better takes into account the cost of cases with multiple comorbidities (as well as multiple impairments). Third, we would like to integrate the analysis of comorbidities with the creation of FRGs to develop a single algorithm that produces Function Related Groups with comorbidities (FRGCs).

UNUSUAL CASES

The FRGC system whose development was described in the previous section is appropriate only for typical cases—the approximately 80 percent of cases discharged to the community following completion of their rehabilitation program. We also analyzed options for paying for the remaining cases.

Table 2

Conditions in Each Comorbidity Tier

Condition	Tier
Ventilator	1
Miscellaneous throat problems	1
Candidiasis (selected)	1
Tracheostomy	1
Vocal cord paralysis	1
Malnutrition	1
Intestinal infection, clostridium	2
Dialysis	2
Pseudonomas	2
Other infections	2
Cachexia	2
Dysphagia	2
Gangrene	2
Meningitis and encephalitis	2
Renal complications of diabetes	3
Hemiplegia	3
Aplastic anemia and selected anemias	3
"Major" comorbidities in acute care	3
Obesity	3
Esophageal conditions	3
Pneumonia	3
Non-renal complications of diabetes	3
Amputation of lower extremity	3

NOTE: The ICD-9-CM codes that define each condition are found in Carter et al. (2001).

Payment for Transfer Cases

Short-stay transfers are defined as cases transferred, before the mean length of stay (LOS) for their FRGC, to hospitals or institutions that are paid as nursing homes by Medicare or Medicaid. If short stay transfer cases were to receive a full FRGC payment, most of these cases would be substantially overpaid relative to typical cases. The average payment-to-cost ratio for short stay transfer cases would be about 1.7. The payment-to-cost ratio for transfers to hospitals would be 2.0.

The potential profit from these cases might provide incentives for abuse. In order to avoid these incentives, it is prudent to implement a reduced payment for short stay transfers. It would not be prudent to reduce the payment for such cases much below expected cost. We do not want to discourage appropriate transfers that provide beneficiaries with needed services. Further, too-low payments for transfer cases or very short stay cases might have the unwanted effect of reducing access to inpatient rehabilitation for patients with a good, but not certain, chance to complete inpatient rehabilitation and return to the community.

Based on our model of the cost of transfer cases, the payment system that would best match payments to cost would be a per diem payment equal to the average payment for a day in the FRGC plus an

additional case-level payment of one-half of the per diem, and we recommend such a payment. This recommendation was accepted in the final rule.

Payment for Deaths and Atypical Short Stay Cases

In our matched data set, 1.9 percent of discharges are not transfers and yet stay less than three days and cost much less than other cases. Even fewer cases die in the hospital—about one-half of one percent. On average, in-hospital death cases also cost less than typical cases in the same FRGC. The final set of CMGs includes a single group for atypical short stay cases. The death cases are subdivided by whether they were assigned to an orthopedic RIC and by LOS. These are the last CMGs in Table A.1.

Bundling

A patient's rehabilitation program is sometimes interrupted for a short period of time, usually because the patient has an episode of acute illness. Our analysis addresses the results of bundling two rehabilitation stays whenever the interruption ends with the patient returning to the same IRF within a short period of time. Only 29 percent of patients whose program is interrupted for less than a calendar day are discharged. Paying for each of these discharges would raise issues of fairness, so it seems very reasonable to bundle these cases. They would be slightly overpaid if each part of the stay received a full discharge payment. There are very few such cases, so it is unlikely to pose a substantial problem to any hospital.

Beyond the same-day interruptions, there is no analytical reason to choose any one particular period as the bundling criterion. We find discharges for over 80 percent of all recorded interruptions up to 30 days in length, so we expect that hospitals discharge patients with any interruption of more than 24 hours. For any period up to 10 days we would pay about the same 70 percent of costs as we do for the interval proposed in the NPRM that includes three calendar days. Using a per discharge payment, including a per diem payment for transfer cases, accurately matches payments to cost.

Based on these payment-to-cost ratios, we recommended that discharges for an interruption of more than 24 hours not be bundled. However, CMS chose to bundle two successive discharges if the patient returned to the same rehabilitation program within three days (i.e., on the day of discharge or either of the following two calendar days).

WEIGHTS

For any particular hospital, the payment for each case will be proportional to the relative weight assigned to the patient's CMG. To ensure that beneficiaries in all CMGs will have access to care and to encourage efficiency, we want to calculate weights that are proportional to the resources needed by a typical case in the CMG. So, for example, cases in a CMG with weight of 2 will typically cost twice as much as cases in a CMG with a weight of 1.

The average of the relative weights for a set of cases is called the case mix index, or CMI. The CMI is the statistic that adjusts hospital payment for differences in case mix. The CMIs for cases at different hospitals can be compared in order to describe the relative costliness of each hospital's case mix.

We expect that the variation in costs across hospitals (especially between newer and older hospitals) is in part an artifact of TEFRA. One of our empirical findings from the interim report is that controlling for hospital costs using individual hospital identity results in estimates of the effect of comorbidity that are more precise than using either standardized cost or standardized charges. In this report, therefore, we updated the weight calculations using the Hospital Specific Relative Value (HSRV) method chosen in the interim report (and in the NPRM) and using new data and our new definitions of CMG.

In the resulting weight regression, the effects of our comorbidity tiers are highly significant, very precise in large RICs, reasonably precise in all RICs, and almost always monotonic. The small deviations in monotonicity were corrected by averaging.

The HSRV weights, however, exhibit CMI compression—i.e., hospitals with a high case mix index have costs that are higher relative to their CMI than hospitals with lower CMIs. The improved FRG and comorbidity definitions have only a small effect on measured compression. We show evidence that strongly suggests that part of the compression problem arises from the bundling of variable ancillary services into the routine per diem. Insofar as this is true, the hospital cost-per-case estimates are more accurate than the patient-level cost estimates. Therefore it makes sense to "decompress" the weights using the relationship between hospital cost per case and the CMI. This adjustment to the weights results in only a small change to individual weights and an even smaller change to the CMI at any hospital. Over half of hospitals would have changes of 1 percent or less in the CMI. A hospital at the 95th percentile would see its CMI increase by 2.4 percent.

We compared simulations using the HSRV (compressed weights) and the decompressed weights. We found the compressed weights overpaid hospitals in the lowest CMI quartile—a payment-to-cost ratio of 1.04—but that the decompressed weights cut this ratio to 1.02. The decompressed weights had a payment-to-cost ratio of 1.00 for the hospitals in the highest CMI quartile. There was no noticeable difference between the ratios for any other class of hospitals. Thus these simulations reinforce the value of the decompression algorithm.

FACILITY-LEVEL ADJUSTMENTS

We analyzed potential facility-level adjustments to the national payment amounts. These are factors that may account for systematic cost differences that are beyond the control of facility management and may be appropriate to recognize in the payment system. In addition to the statutorily mandated wage index, our interim report recommended that adjustments be made for serving low-income patients and for location in a rural area (i.e., outside a Metropolitan Statistical Area). This report updates the analyses in the interim

report using more-recent data and improved measures for factors that may account for systematic cost differences.

Methodology

We updated and refined the explanatory variables that we used in the interim report. Next, we performed multivariate regression analyses to measure the effects of the factors on facility costs and establish potential payment adjustments. In "fully specified" regressions, we included a comprehensive set of explanatory regressions in order to understand the various factors that might affect cost per case. In our "payment" regressions, we limited the explanatory variables to those that are beyond the control of facility management and might be appropriate to recognize in the payment system. Within the payment regressions, we explored alternative ways of specifying the size of the facility's low-income population.

We used the coefficients from the payment regressions to determine potential adjustment factors for payment variables. We then simulated payments using the 1999 cases in our analysis file and determined the payment-to-cost ratios for different classes of hospitals for specific combinations of payment policies. We also undertook supplemental analyses to understand some of the regression and simulation results.

Low-Income Variable

Since the log of 0 cannot be taken, we added a constant to the low-income ratios in our regressions. The payment adjustment recommended in the interim report and used in the NPRM was based on the log (0.0001 + DSH) form of the low-income variable, where DSH is the percentage of Medicare patients who are entitled to SSI plus the percentage of all inpatients who are eligible for Medicaid.[1] Here we considered other variables using DSH (e.g., log (1 + DSH)) and replacing DSH with other descriptions of the low-income population.

The statistical performances of most alternatives were roughly similar. There is about a 5 percent increase in costs for each 10 percentage point increase in a facility's DSH ratio. A variable using the percentage of all patients who are either Medicare beneficiaries entitled to SSI or are non-Medicare patients eligible for Medicaid has similar results to the DSH percentage. A variable using only the percentage of Medicare patients who are entitled to SSI does not have as much explanatory power.

If we use the log (0.0001 + DSH) form that was used in the NPRM, the slope of the low-income patient adjustment is quite steep at the lowest DSH ratio—i.e., the low income patient adjustments for facilities with very low DSH ratios increase rapidly with small increases in the DSH ratio. Another problem

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[1]The name of the variable, DSH, was originally derived from "disproportionate share." The same variable is calculated within the acute care PPS. In the acute PPS, DSH is treated as if it were 0 below specific thresholds, and thus DSH payments are made only to hospitals with a "disproportionate share" of low income patients. In the IRF PPS, low-income patient adjustments go to all hospitals with any low-income patients and thus the adjustment is called a low-income patient (LIP) adjustment in the final rule (CMS, 2001).

with this form is that normalizing the adjustment factor to 1.0 for a facility with a 0 DSH ratio created misunderstanding regarding the size of the low-income patient adjustment relative to total payment. In fact, the payments for hospitals across the range of DSH values where most hospitals are concentrated would be very similar using either the log (0.0001 + DSH) or log (1 + DSH) form.

It is possible to mitigate the slope problem at the low DSH ratios by using a threshold so that all hospitals with a DSH ratio below the threshold have a low-income patient adjustment factor of 1.0. However, the exact location of the threshold would be arbitrary. If the threshold were high enough to eliminate the slope problem, the payment formula would perform very similarly to that from the log (1 + DSH) form, except in the region containing the few hospitals with the highest DSH values. For these hospitals the log (1 + DSH) form produces a larger payment adjustment. Using the log (1 + DSH) form, the payment-to-cost ratio for hospitals with a DSH ratio of 0.30 or higher is 1.07 compared with 1.025 using the log (0.0001 + DSH) form with a 5 percent threshold. Although the 0.0001 + DSH form fits the data better in this region (and has a slightly higher R-square overall), the higher payment-to-cost ratio for the highest DSH hospitals using the log (1 + DSH) form may not be a policy concern. CMS chose to adopt the log (1 + DSH) adjustment in the final rule implementing IRF PPS.

Geographic Areas

The payment regression shows that rural hospitals are almost 19 percent more costly than other hospitals. Large urban hospitals are almost 4 percent less costly than other urban hospitals. The rural finding is highly significant while the large urban coefficient is only slightly significant and may be attributable to "outlier" hospitals.

The payment simulations indicate that a rural adjustment works well. The payment-to-cost ratios for both rural and urban facilities are close to 1.00. The average payment-to-cost ratio for facilities in large urban areas (1.01) is only slightly higher than for other urban hospitals (0.99) and rural hospitals (0.99). We recommended making an adjustment for hospitals located in rural areas but not for hospitals located in large urban areas (which would be negative) at this time. CMS adopted our recommendation in the final IRF PPS rule.

Differences in practice patterns do not appear to be contributing to the higher costs of care in rural hospitals. The lengths of stay and transfer rates in rural hospitals are similar to predicted values based on patient mix. With regard to large urban facilities, their average LOS is also close to predicted values. The transfer rates to hospitals—both total and short-stay—are slightly higher than expected and could be a possible factor in explaining the lower costs per case of large urban hospitals. In addition, other urban hospitals report a lower proportion of cases with comorbidities and have a slightly longer than expected average LOS. It is not clear whether this is attributable to differences in practice patterns and/or coding practices. We believe this issue should be reexamined after data from IRF PPS become available.

One issue raised by the interim report was whether the facility adjustment for rural hospitals should instead be an adjustment for serving rural patients, so that urban hospitals that serve a substantial number of rural beneficiaries would also receive a payment adjustment. We found that rural patients in urban hospitals are about 1 percent more costly than their urban counterparts in the same hospital. About 4 percent of urban facilities draw more than half of their patients from rural areas. While these hospitals might be at a slight disadvantage, the magnitude of the disadvantage is very small and we do not believe an adjustment would be appropriate. Urban patients who are in rural hospitals are also more costly than their rural counterparts. Thus, the underlying issue may be whether or not patients who travel out of area for inpatient care are more costly. Refinements in the patient classification system would be preferable to a facility adjustment for these small numbers of patients.

Other Hospital Characteristics

Key findings from the regressions include the following:

- In the fully specified regressions using a comprehensive set of explanatory variables, the following variables are significant in explaining variation in cost per case: case mix, wage index, the proportion of low-income patients, type of facility (freestanding hospital or unit), certification date, size, and geographic location. In the interim report, teaching and type of ownership were also significant in the fully specified regression.
- Teaching is not significant in either the fully specified or payment regressions using any of several different measures of teaching intensity. However, problems measuring interns and residents may have affected our results. We found inconsistencies between the resident counts and the allocation of resident salaries, and between the ratio of residents to average daily census and the Residency Review Committee requirements related to patient load.
- The wage index is compressed when we define it as an independent variable. This result, which is different from our interim report finding, implies that the wage index may overstate the resources required in low-wage areas and understate the resources required in high-wage areas. We believe that this compression is attributable to a small number of influential "outlier" hospitals. When these hospitals are controlled for in the regression, the wage index is less compressed.

The issue of whether patterns of care contribute to the higher costs of freestanding hospitals is clouded by uncertainty over coding reliability. Freestanding hospitals report fewer comorbidities in each tier and have an LOS that is about 16 percent longer than the expected LOS for the patient mix. This issue should be examined after IRF PPS is implemented and hospitals have responded to the payment incentives to improve coding practices and to deliver care more efficiently.

We remain concerned about the small number of hospitals with the greatest teaching intensity because they appear to be underpaid relative to costs. Resolution of this problem, however, must wait for better data on interns and residents who serve in IRFs.

OUTLIER PAYMENTS

Outlier payments are additional payments, beyond the normal CMG payment, made for very expensive cases. Such payments can reduce hospitals' financial risk from a PPS and should reduce the PPS incentive for hospitals to underserve very expensive cases. Also, because they are targeted to cases where the CMG payment is much lower than cost, outlier payments may help mitigate problems with the classification system. Because outlier cases are not paid at full cost, these payments cannot completely fix problems with the classification system; they can only provide limited compensation.

There are several drawbacks to outlier payments: Because payments are tied to costs, outlier payments may encourage hospitals to provide care that has less value than its cost. Further, because charges are used to measure costs, it might be possible for some hospitals to game their charging structure to obtain an unwarranted portion of the outlier payments. Finally, because hospital behavior may change after implementation of the IRF PPS, there is uncertainty about the relationship between the outlier parameters and the total amount of funds that will be spent on outlier payments. Thus, the more outlier payments that are planned, the larger the possible difference between realized total payment and the budget neutrality target.

We simulated payments to evaluate quantifiable outcomes of different targets for the amount of outlier payments: from no outlier payments to 5 percent of total payments in 1 percent increments. The outcomes we evaluated include financial risk and the match of payments to costs at each hospital and at groups of hospitals. The findings from these simulations of payment on 1999 cases are very similar to those on the 1997 data presented in our interim report:

- Increasing the amount of outlier payments decreases financial risk, but the rate of improvement decreases.
- Increasing the amount of outlier payments also increases the match between payment and cost at the hospital level—but also at a decreasing rate.
- Increasing the amount of outlier payments has little effect on the payment-to-cost ratio of groups of hospitals.

We then attempted to weigh the measured effects against other unquantified effects in order to reach a recommendation and found no reason to change the recommendation in our interim report—the outlier target should be set at 3 percent of total IRF PPS payments. CMS chose the same 3 percent value in the final rule.

RELATIONSHIP BETWEEN HOSPITAL PAYMENT AND COST IN THE IRF PPS

The simulations also allow us to summarize the performance of a PPS that incorporates each of our major recommendations for policy: the classification system; payment for short-stay transfer cases; HSRV weights; the facility payment adjustment that uses the hospital wage index, rural location, and DSH

percentage; and the 3 percent level of outlier payment. The classification system used for unusual cases was described earlier and includes bundling.

The accuracy of the system at the hospital level is summarized by the standard deviation of the difference between average payment and average cost. As shown in Table 3, the average payment per case at each hospital explains 57.1 percent of the variance across hospitals in cost per case.

Table 3

Percent of Variance in Facilities' Cost Explained by the IRF PPS

Standard deviation of cost per case	$3,651
Standard deviation of difference between payment and cost per case	$2,390
Percent of the variance in cost explained by payment (Efron R-Square)	57.1%

The report also presents the payment-to-cost ratio for various groups of hospitals. For most characteristics that we examined, the ratios are within 3 percent of 1.00. The smallest ratio is for very small freestanding hospitals that may lack economies of scale.

CONVERSION FACTOR

Congress mandated that the payment system in FY 2002 must be designed to be budget neutral—that is, estimated IRF PPS payments per case in FY 2002 must equal the estimated amount of TEFRA payments per case.[2] We assessed alternative methods for determining the national conversion factor. Each of the methods assumes that the cases at each hospital in FY 2002 will be similar to the hospital's cases in 1999. Our computation accounts for facility adjustments and outlier payments. Since the conversion factor multiplies all IRF PPS case payments, it is a key to meeting the congressional budget neutrality requirement.

We assessed the accuracy of the method proposed in the NPRM, along with four alternatives. The NPRM method was the only one available at the time and uses only case data from the matched FIM-MEDPAR sample. However, we actually know a lot about the non-sample hospitals—in particular we know their TEFRA payment, their facility adjustment factor, and their characteristics such as rural location and freestanding status. Further, we know something about their case mix. We know the number of cases whose rehabilitation followed a hospitalization for stroke, the number of cases that followed a joint replacement, and so on. Diagnoses on the MEDPAR rehabilitation record tell us more about case mix. Further, the LOS and the discharge destination for the case can help predict its case weight.

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[2]It was mandated that the budget neutrality calculation ignore hospital decisions to move entirely to the IRF PPS in FY 2002.

In addition to sample data, our four alternative models used hospital characteristics and case characteristics of the non-sample MEDPAR cases to estimate the CMI of non-sample hospitals and cases. We then combined these CMI estimates with known information about TEFRA payments and the IRF PPS facility adjustment to estimate the conversion factor. We evaluated these alternatives using four tenfold cross-validation runs.

We found that all of the models are substantially more accurate than the NPRM method. Thus we would be better off using our data to estimate the CMI at hospitals. Further, a model based on case-level data appeared to be the most accurate. It reduced the typical error in the conversion factor from a 10 percent validation sample by slightly more than half of the error in the conversion factor from the NPRM method.

We then estimated the actual conversion factor using each of these models. We did so by combining the actual data for the sample cases with CMI predictions from the models for other hospitals and/or cases. The model that we believe is most accurate results in a conversion factor of $11,977, which is 1 percent greater than the conversion factor from the NPRM method. The majority of this increase occurs because hospitals are less likely to report very short stay cases to the FIM databases.

Our estimate assumes no behavioral response to the PPS. The CMS Actuary calculated a behavioral offset to this conversion factor based on historical experience with new payment systems. The calculation reflected reduced cost (and therefore reduced TEFRA payment) achieved by transfers to home health care and long-stay transfers to institutions. Thus the national conversion factor used in the final rule was $11,838, which is 1.16 percent lower than the conversion factor we calculated under the assumption of no change in behavior.

ASSESSMENT INSTRUMENTS FOR PPS

This project analyzed whether the use of the Minimum Data Set–Post Acute Care (MDS-PAC) as proposed in the NPRM would adversely affect system performance, patients, or hospitals. FIM and PAC data on more than 3,000 cases from 50 hospitals were collected. Three calibration teams re-rated the FIM and the PAC on more than 200 of these cases.

Coding the Impairment That Is the Primary Reason for Admission

The study found that there were problems and notable disagreement with impairment group code selection regardless of which instrument was used. When data collectors were required to record an impairment code (without the benefit of having a menu to select from), codes were missing or invalid (meaningless) 10–11 percent of the time. When the calibration teams were asked to score the same cases that institutional data collectors had scored, 27–29 percent of the time either one or both of the teams used an invalid code or, when both used valid codes, the codes mapped into different rehabilitation impairment

categories. This finding indicates a need for additional rules and clarifying instructions governing rehabilitation impairment group selection.

Estimating FIM Scales from MDS-PAC Data

In order to classify patients into CMGs using the MDS-PAC, motor and cognitive scales similar to those in the FIM were created from items in the PAC. For the cognitive scale we used a translation developed by Dr. John Morris; for the motor items we built on and revised his initial work.

While parsimonious in length, the FIM actually has a fairly complex set of scoring rules. Some of these rules differed explicitly from those in the PAC; others merely could not be replicated. One of the most obvious issues was the difference in the assessment periods: The PAC looked back at the first three days after admission and the FIM looked back over 24 hours anytime during the first three days. Further, distinguishing independence from modified independence was often difficult. Information on use of devices was frequently inadequate to score modified independence due to use of devices. The FIM also scored patients who would otherwise be independent but who took more than a reasonable amount of time, or those for whom there was a safety concern, as having modified independence. None of these distinctions was captured in the PAC or its item scoring. The scoring for total assistance (dependence) was substantially different for the two instruments. In the FIM, patients were scored as requiring total assistance when they performed fewer than 25 percent of the subtasks or work associated with the item. The MDS-PAC coded total assistance when the patient did not participate in the activity and required full staff performance.

We evaluated our "revised" translation and demonstrated that it did, in fact, reduce the mean difference in motor scores between the FIM and the PAC by 50 percent from the original Morris translation. Despite the improvement, we found that the agreement between the instruments as measured by kappa statistics was poor to moderate. Comparing the levels of instrument agreement between the institutional teams and our calibration teams, we found that the calibration teams had notably higher levels of agreement between the FIM and the PAC.

Although much of the difference in motor scores was due to differences in the scoring rules, some resulted from scoring error in both the MDS-PAC and the FIM. For example, the fact that some of the scoring rules were counterintuitive may have lead to increased scoring error. The MDS-PAC's activities of daily living (ADL) assist codes instructed coders to score one person doing weight-bearing assistance with one limb as a "1" but to combine all other one-person assists (torso, multiple limb, and non-weight-bearing) with the no-assistance group. Another example occurred in the scoring of bowel and bladder appliance support for patients on medication. When a nurse handed an otherwise independently functioning patient a medication, coders were instructed to score the MDS-PAC's appliance support item as maximum assistance. Since hospital policy required that the nurse hand the patient the medication unless patients were on special medication programs (which was unlikely at admission), these patients were all scored as

highly dependent on the MDS-PAC. The situation was exacerbated by including Metamucil, a fiber enhancement given to most hospitalized patients, on the medication list.

We anticipated that differences in the assessment periods between the instruments contributed to the mean difference in motor scores, and we found, in fact, that it did, but not in the simple ways we expected. Patients whose FIM motor exams were completed on day 2 had significantly larger differences than those whose exams were completed on day 1 or day 3. The size of the PAC scoring team also influenced the difference: Two- and three-person teams had less bias than one-person teams and those with four or more. After controlling explicitly for all the variables that we could, we found that a test of random effects for hospitals was highly significant. The latter implied that hospitals were systematic in their scoring differences, but this was not explained by the independent variables. We also tested for random slope effects with patient-level variables and found that some of these were also significant. "Significant differences" here means that different hospitals scored particular types of patients differently. Together, these findings suggest that more training is needed to adequately standardize the assessment process.

Estimating CMGs

Next, we mapped FIM and "pseudo-FIM" motor and cognitive scores into CMGs and tried several different approaches to improve the match between the mappings. We found that the FIM and the MDS-PAC mapped into the same CMG 53 percent of the time initially. We improved the level of agreement to 57 percent by using a regression mapping of "pseudo-FIM" items onto the FIM scores and by dropping the facility with the worst-matching rate. Although this level of CMG agreement between instruments (53–57 percent) was low, scoring reliability within both instruments was also poor and led to low levels of agreement, 50 percent for the FIM and 55 percent for the PAC (when the CMGs from calibration team responses were compared with institutional team responses on the same instrument).

Despite poor classification agreement, mean payment differences between the two instruments were small, averaging –$46, and not significantly different from zero. At the facility level, mean per-case differences increased to $82. Although these differences are not large, we found that more than 20 percent of the facilities experienced revenue differences of 10 percent or more. Our multivariate analysis of payment differences showed significant differences across hospitals, but these were not associated with patient or hospital characteristics.

Reliability and Accuracy

When we compared the scoring concordance (reliabilities) on the two instruments, we found that the FIM had somewhat higher kappas and levels of absolute agreement than the PAC. However, our reliability measures for the FIM motor scale, the cognitive scale, and 11 of 13 motor items were substantially less than those reported in the literature (see the meta-analysis of 11 studies in Ottenbacher et al. (1996)). The meta-analysis did not provide information on how actual FIM assessments were performed

in those studies. Our calibration teams were made up of observers and information gatherers who did not actually do any physical assessment (at times, they were trying to gather information that was as much as three days old), so procedural differences may have contributed to lower reliabilities. However, one could also argue that their greater dependence on information from treating clinicians makes their individual judgment less important and should have increased agreement.

The simplicity of the FIM scoring sheets was deceptive because the actual scoring rules were actually quite complicated. Two examples of explicit questions on the MDS-PAC allowed us to observe how FIM scorers had overlooked scoring nuances. In the "Eating" item, FIM rules instructed that patients with chewing problems, and those on modified diets for swallowing problems who were otherwise independent in eating, should be scored as having modified independence. Assuming that the PAC items were measured without error, patients with chewing problems or those on modified diets were scored correctly only 43 percent of the time. Fortunately, chewing problems and/or diet modifications occur in only 6 percent of otherwise independent eaters. Another example is the FIM locomotion item, which required (with one exception) that patients walk at least 150 feet to score above maximum assistance. Again, assuming that the explicit distance response in the MDS-PAC was correct, we observed that FIM scorers overlooked the distance requirements 16 percent of the time. Among patients who were unable to walk 150 feet, 24 percent were scored incorrectly. Including these elements explicitly should improve scoring accuracy.

Administration Cost

By far the biggest difference between the instruments was their length. Conceptually, the PAC is a much broader instrument. An important limitation of this study is that we have yet to look at the benefits of this expanded conceptual base. The PAC required 147 minutes on average to complete, compared with 25 minutes for the FIM—a sixfold difference. We found a clear learning curve during the study (the average completion time for the first two weeks of the study of 184 minutes fell to 120 minutes for weeks 7 and 8), which could continue to reduce times beyond those reported here. The size of the data collection team also influenced data completion times significantly: The larger the team, the longer the time. By the end of the study, one-person teams had times that were consistent with those reported in the NPRM (85–90 minutes).

Overview of Instrument Analyses

In summary, the instrument study's most important findings were the following:

- Scoring concordance (reliabilities), while somewhat higher on the FIM than the PAC, were not as high as desired for payment.
- The best translations and mappings of the PAC into CMGs agreed with the FIM only 53–57 percent of the time.
- Despite this poor agreement, overall payment differences between the instruments were small.

- Twenty percent of the hospitals could have revenue differences of 10 percent or more, depending upon which instrument is used.
- All of our multivariate analyses showed strong random effects for hospitals with few other significant variables, suggesting that additional training could help standardize responses and remove hospital-specific differences.
- The administrative burden associated with the MDS-PAC, 120 minutes compared with 23 minutes for the FIM by the end of the study, was substantial.

CMS created a new assessment instrument for use with the IRF PPS. It includes the FIM items, but modifies the scoring rules when an activity has not been observed. Further, the new instrument requires that the hospital record additional information about each of the FIM items that were found here to be particularly complex.

MONITORING

A major focus of our ongoing work will be the development of a system to monitor the impact and performance of the IRF PPS. This system will perform two primary functions. First, it will monitor the care delivered by IRFs before and after IRF PPS implementation. It will do this by tracking changes in patient access to care, costs of care, Medicare payments for care, the financial status of IRFs, and the outcomes of IRF care. We will use this information to assess the positive and negative effects of the IRF PPS and to determine if the PPS is meeting its intended goals. We will hypothesize about potential problems with the IRF PPS and monitor whether or not these problems materialize. This effort will involve analyzing regional and national trends in IRF care and identifying unusual hospitals. (No data that could be used to identify individual hospitals will be publicly released.) The monitoring system will also be used to determine areas where the IRF PPS needs refinement.

Second, the system will monitor changes in the care delivered across post-acute care settings. This function is important because the financial incentives created by the IRF PPS may affect the number and mix of patients using other types of post-acute care and because changes in the payment systems for other types of care may affect the patients admitted to IRFs. We will thus track changes in the number and types of patients seeking care across the range of post-acute care settings. We will then assess the implications of these care patterns for costs to beneficiaries, providers, and the Medicare program as a whole. We will also assess trends in the outcomes of post-acute care, including mortality rates and hospital readmissions.

The monitoring system will be designed with input from the TEP and from CMS and will draw on analyses conducted during phase I. Baseline measures of cost, access, and quality will be developed over the next year. Post-implementation data will be analyzed and evaluated starting in fall 2002.

APPENDIX

Table A.1

Definitions of CMGs

CMG Number	Rehabilitation Impairment Category	Functional Status and Age
0101	Stroke	Motor score 69–84 and cognitive score 23–35
0102	Stroke	Motor score 59–68 and cognitive score 23–35
0103	Stroke	Motor score 59–84 and cognitive score 5–22
0104	Stroke	Motor score 53–58
0105	Stroke	Motor score 47–52
0106	Stroke	Motor score 42–46
0107	Stroke	Motor score 39–41
0108	Stroke	Motor score 34–38 and patient is 83 years old or older
0109	Stroke	Motor score 34–38 and patient is 82 years old or younger
0110	Stroke	Motor score 12–33 and patient is 89 years old or older
0111	Stroke	Motor score 27–33 and patient is between 82 and 88 years
0112	Stroke	Motor score 12–26 and patient is between 82 and 88 years
0113	Stroke	Motor score 27–33 and patient is 81 years old or younger
0114	Stroke	Motor score 12–26 and patient is 81 years old or younger
0201	Traumatic brain injury	Motor score 52–84 and cognitive score 24–35
0202	Traumatic brain injury	Motor score 40–51 and cognitive score 24–35
0203	Traumatic brain injury	Motor score 40–84 and cognitive score 5–23
0204	Traumatic brain injury	Motor score 30–39
0205	Traumatic brain injury	Motor score 12–29
0301	Non-traumatic brain injury	Motor score 51–84
0302	Non-traumatic brain injury	Motor score 41–50
0303	Non-traumatic brain injury	Motor score 25–40
0304	Non-traumatic brain injury	Motor score 12–24
0401	Traumatic spinal cord injury	Motor score 50–84
0402	Traumatic spinal cord injury	Motor score 36–49
0403	Traumatic spinal cord injury	Motor score 19–35
0404	Traumatic spinal cord injury	Motor score 12–18
0501	Non-traumatic spinal cord injury	Motor score 51–84 and cognitive score 30–35
0502	Non-traumatic spinal cord injury	Motor score 51–84 and cognitive score 5–29
0503	Non-traumatic spinal cord injury	Motor score 41–50
0504	Non-traumatic spinal cord injury	Motor score 34–40
0505	Non-traumatic spinal cord injury	Motor score 12–33
0601	Neurological	Motor score 56–84
0602	Neurological	Motor score 47–55
0603	Neurological	Motor score 36–46
0604	Neurological	Motor score 12–35
0701	Fracture of lower extremity (LE)	Motor score 52–84
0702	Fracture of lower extremity (LE)	Motor score 46–51
0703	Fracture of lower extremity (LE)	Motor score 42–45
0704	Fracture of lower extremity (LE)	Motor score 38–41
0705	Fracture of lower extremity (LE)	Motor score 12–37
0801	Replacement of LE joint	Motor score 58–84
0802	Replacement of LE joint	Motor score 55–57
0803	Replacement of LE joint	Motor score 47–54
0804	Replacement of LE joint	Motor score 12–46 and cognitive score 32–35
0805	Replacement of LE joint	Motor score 40–46 and cognitive score 5–31

Table A.1 (continued)

0806	Replacement of LE joint	Motor score 12-39 and cognitive score 5–31
0901	Other orthopedic	Motor score 54–84
0902	Other orthopedic	Motor score 47–53
0903	Other orthopedic	Motor score 38–46
0904	Other orthopedic	Motor score 12–37
1001	Amputation, LE	Motor score 61–84
1002	Amputation, LE	Motor score 52–60
1003	Amputation, LE	Motor score 46–51
1004	Amputation, LE	Motor score 39–45
1005	Amputation, LE	Motor score 12–38
1101	Amputation, other than LE	Motor score 52–84
1102	Amputation, other than LE	Motor score 38–51
1103	Amputation, other than LE	Motor score 12–37
1201	Osteoarthritis	Motor score 55–84 and cognitive score 34–35
1202	Osteoarthritis	Motor score 55–84 and cognitive score 5–33
1203	Osteoarthritis	Motor score 48–54
1204	Osteoarthritis	Motor score 39–47
1205	Osteoarthritis	Motor score 12–38
1301	Rheumatoid, other arthritis	Motor score 54–84
1302	Rheumatoid, other arthritis	Motor score 47–53
1303	Rheumatoid, other arthritis	Motor score 36–46
1304	Rheumatoid, other arthritis	Motor score 12–35
1401	Cardiac	Motor score 56–84
1402	Cardiac	Motor score 48–55
1403	Cardiac	Motor score 38–47
1404	Cardiac	Motor score 12–37
1501	Pulmonary	Motor score 61–84
1502	Pulmonary	Motor score 48–60
1503	Pulmonary	Motor score 36–47
1504	Pulmonary	Motor score 12–35
1601	Pain syndrome	Motor score 45–84
1602	Pain syndrome	Motor score 12–44
1701	Major multiple trauma (MMT) without brain or spinal cord injury	Motor score 46–84
1702	MMT without brain or spinal cord injury	Motor score 33–45
1703	MMT without brain or spinal cord injury	Motor score 12–32
1801	MMT with brain or spinal cord injury	Motor score 45–84 and cognitive score 33–35
1802	MMT with brain or spinal cord injury	Motor score 45–84 and cognitive score 5–32
1803	MMT with brain or spinal cord injury	Motor score 26–44
1804	MMT with brain or spinal cord injury	Motor score 12–25
1901	Guillian-Barré	Motor score 47–84
1902	Guillian-Barré	Motor score 31–46
1903	Guillian-Barré	Motor score 12–30
2001	Miscellaneous	Motor score 54–84
2002	Miscellaneous	Motor score 45–53
2003	Miscellaneous	Motor score 33–44
2004	Miscellaneous	Motor score 12–32 and patient is 82 years old or older
2005	Miscellaneous	Motor score 12–32 and patient is 81 years old or younger
2101	Burns	Motor score 46–84
2102	Burns	Motor score 12–45
5001	Atypical short stays	LOS is 3 days or fewer
5101	In-hospital death	Orthopedic, LOS is 13 days or fewer
5102	In-hospital death	Orthopedic, LOS is 14 days or more
5103	In-hospital death	Not orthopedic, LOS is 15 days or fewer
5104	In-hospital death	Not orthopedic, LOS is 16 days or more

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